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Active Spaces

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Workspace of the Future

- **Built on existing workspace infrastructure**
- **Add high-tech IT**
- **Enhance work experience**
- **Improve productivity**
- **Responsive**
- **Not intimidating**
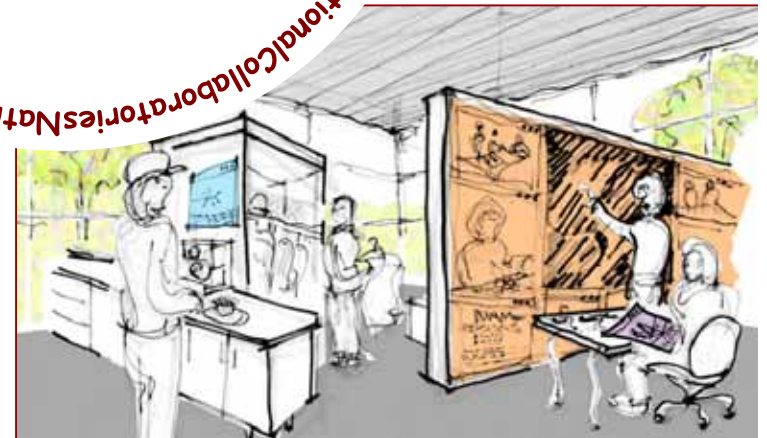
Related Projects
Living and Dead

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- **Office of the Future (http://www.cs.unc.edu/Research/stc/)**
  - better everyday graphical display environment, 3D tele-immersion capabilities that allow distant people to feel as though they are together in a shared office space

- **iWork (http://iwork.stanford.edu)**
  - exploring new possibilities for people to work together in technology-rich spaces with computing and interaction devices on many different scales

- **i-Land (http://www.ipsi.fraunhofer.de/ambiente)**
  - integrated design of real spaces and virtual spaces allowing for dynamic configuration and flexible allocation of resources for project teams

- **Easy Living (http://research.microsoft.com/easyliving/)**
  - prototype architecture and technologies for building intelligent environments

- **AIRE (http://www.ai.mit.edu/projects/aire/)**
  - Agent-based Intelligent Reactive Environments

- **Gaia (http://choices.cs.uiuc.edu/gaia/)**
  - brings the functionality of an operating system to physical spaces

Enabling Groups & Groups of Groups

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- **Visually and interactively investigate large scientific datasets**

- **Shared collaborative spaces must create illusion of persistent, shared resources**

- **Ambient connectivity – audio, video, sensors**

Challenges

- **Cross-cutting**
  - **Collaboration environments**
  - **Advanced display technologies**
  - **Advanced visualization systems**
  - **Novel networking**
  - **Sensor agents**

- **Integration Architecture**
  - **Diverse components**
  - **Seamless ad hoc inclusion**
  - **Capability-scaled / adaptive**

KEY FEATURES

- **Space Design – *encourage users to congregate***
  - *Comfortable, Flexible, Attractive, Compelling*
- **Tightly Integrated**
  - Computing, Communications, Devices (cameras, displays, microphones, etc.)
- **Interface – *natural set of interaction modalities***
  - Hands free audio, multi-perspective video, 3D vis, direct manipulation and control
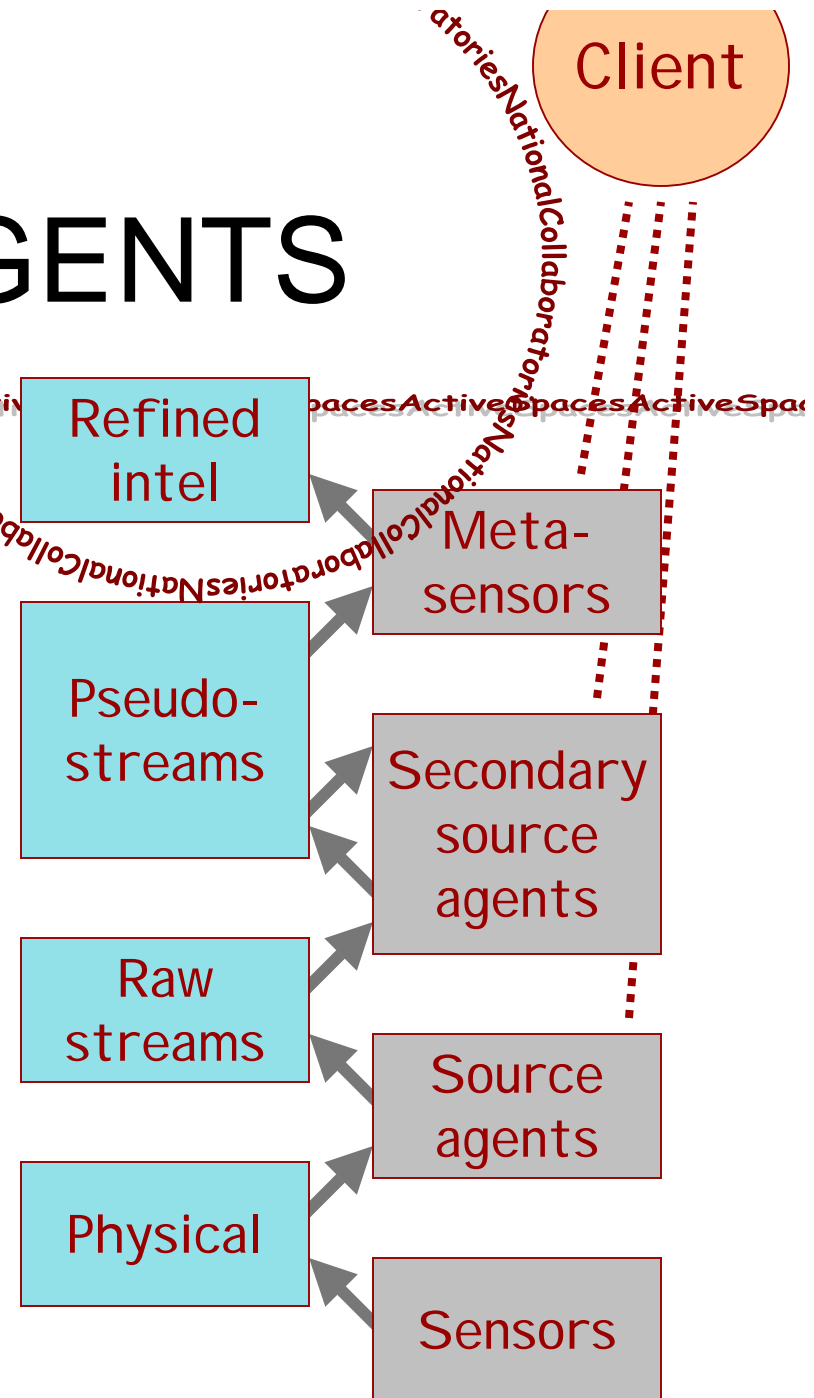
KEY FEATURES

- **Personal Resource Integration –** *"Here, I want to show you something…"*
  - **Laptop, Phones, PDAs**

- **Interconnecting Collaboration and Visualization**
  - **System architecture, Physical and software integration, High performance networking, Matching disparate capabilities**

- **Middleware Services –** *high level abstractions*
  - **Multimodal communication, Security, Scheduling, Resource management**

SENSOR AGENTS

- **Cues**
  - audio highlighting
  - video layout
- **Environment**
  - noise and light level
  - movement, crowded, hot, commotion
- **Interaction & control**
  - voice, gesture, virtual widgets, object manipulation

- **Monitoring**
  - "tell me when [he arrives]"
- **High level queries**
  - "Who is speaking?"
  - "Where is Mike?"
- **Dynamic identifications**
  - Speaker, audience, pizza guy
  - Where is that sound coming from? (which physical space, CD player)
- **Engage Personal Agents**
  - "…you have mail"
  - "your teragrid job started"

SENSOR AGENTS

- **Derived "meta-sensors"**
  - combined: vision, audio, …
  - {intra/inter}-space
- **Object tracking, segmentation, depth**
- **Internal state**
  - network quality, venue data

- **Streams & Events**
- **Discovery**
- **Subscription, Query**

Client

Refined intel

Pseudo-streams

Raw streams

Physical

Meta-sensors

Secondary source agents

Source agents

Sensors

Sowing Active Spaces

- **Must be widely used across wide range of applications by a large community**

- **Technology must be empowering**

- **Environments must be compelling**

- **Integrated into existing modern intellectual work spaces**

- **Hale and hearty Community**

INCENDIARY CONCLUSION

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- **What do we want?**

  – **ACTIVE SPACES!**

- **When do we want them?**

  – **NOW!**